

Optimizations in Iris Recognition

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Acknowledgments

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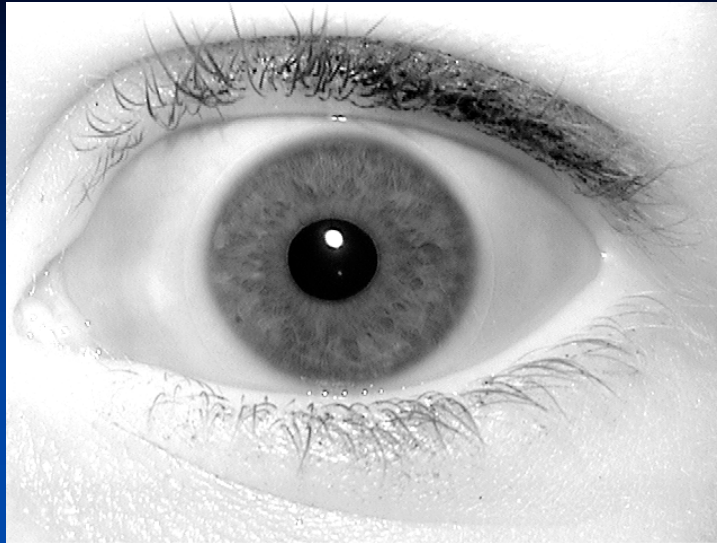
Outline

- Introduction
- Experiments on Iris Recognition
 - Data acquisition
 - Implementation & Optimization
 - Results
- Final Remarks
- Citation
- Conclusion

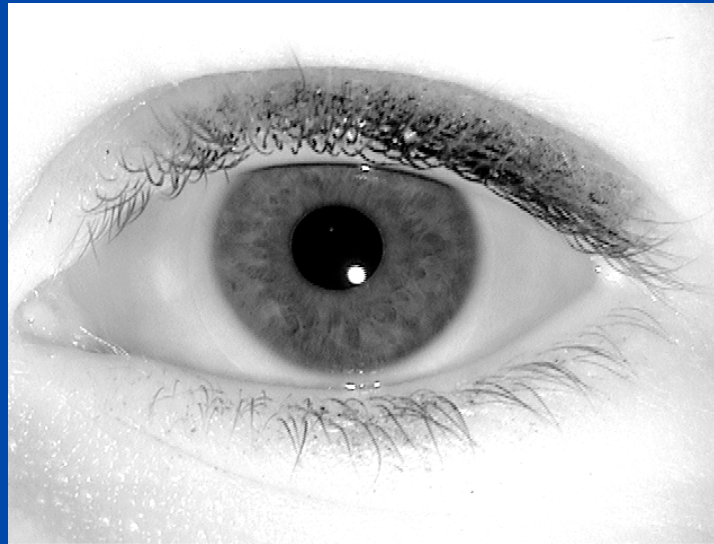
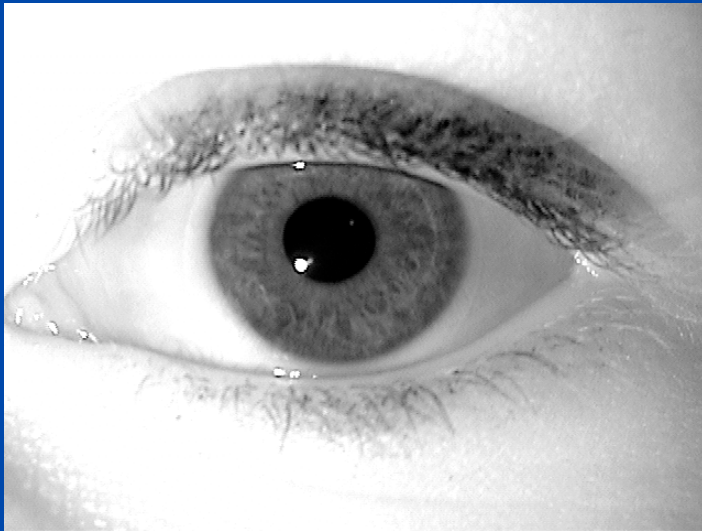
Data Acquisition

- LG EOU2200 system
- 640x480 Intensity Images



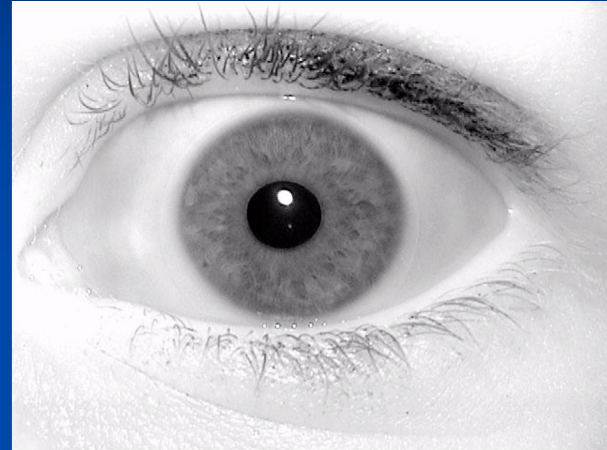


Quality Metrics:
Iris (226, 298, 114)
Pupil(228, 288, 41)
Percent Iris=98;
Focus=98;
Motion Blur=0

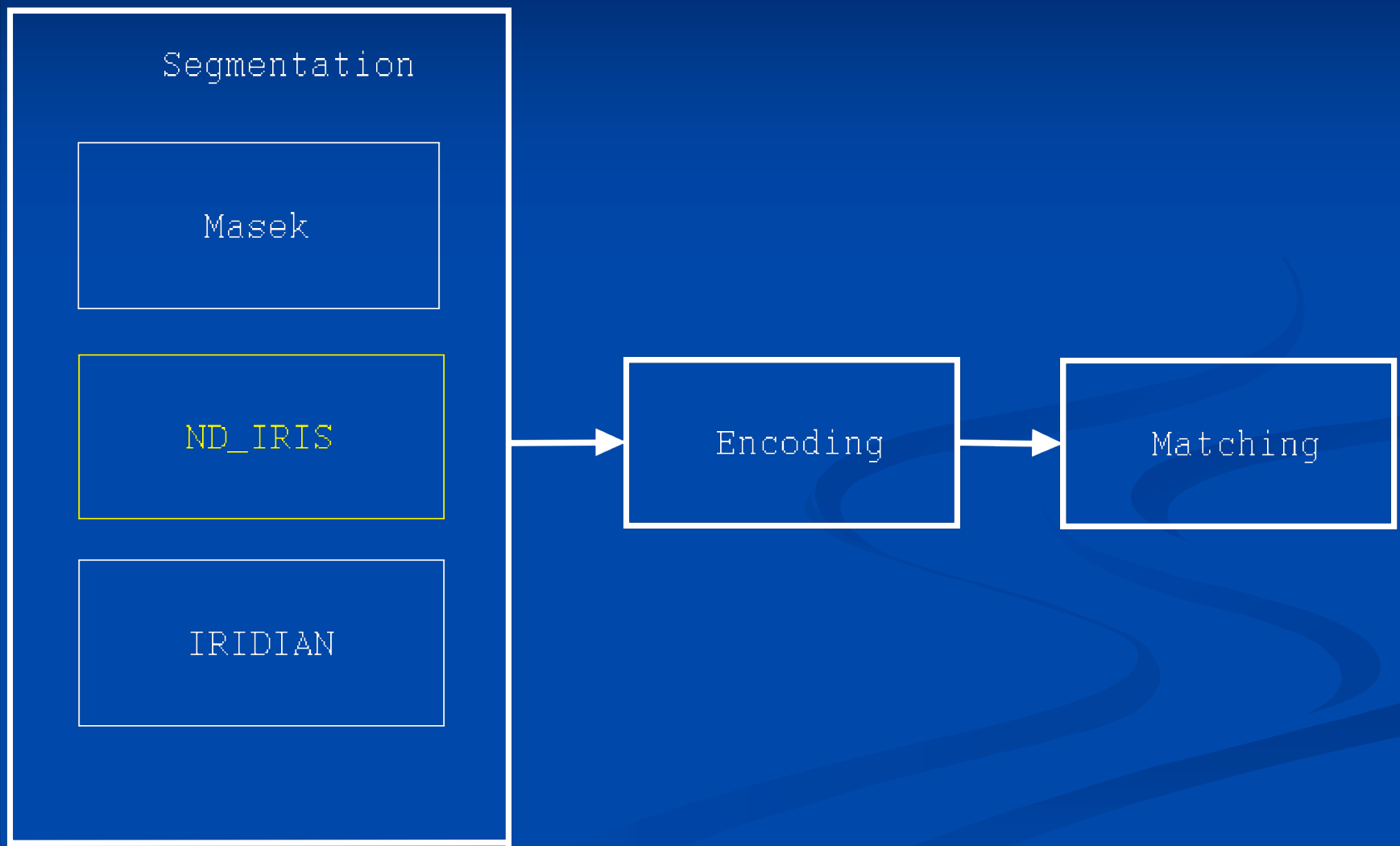


Data Sets

- ICE: Iris Challenge Evaluation
(<http://iris.nist.gov/ice/>)
- Gallery Set
 - Left iris images: 317
 - Right iris images: 327
- Probe Set: a superset of the ICE 1.0 data

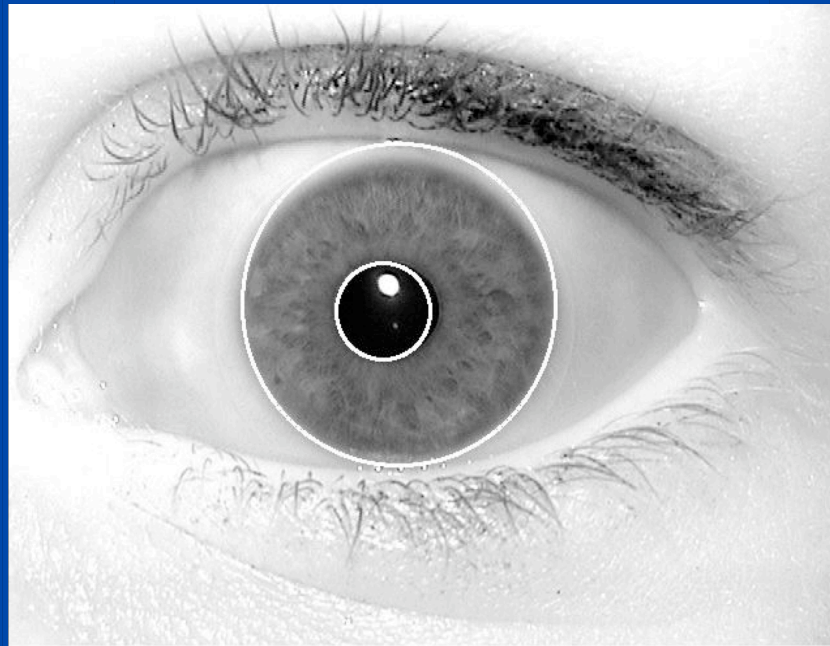


Iris Recognition



Masek's Segmentation

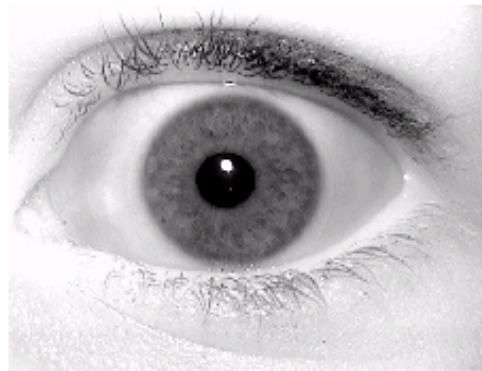
- Canny Edge Detector
- Hough Transform



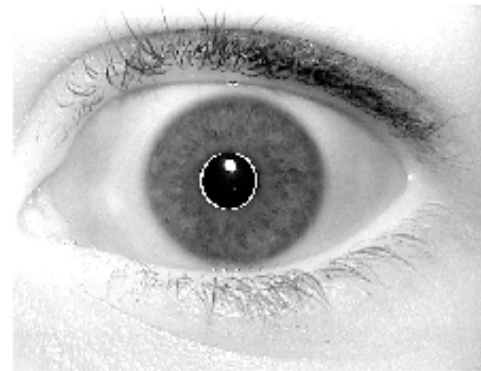
Optimizations in Iris Segmentation

- Reverse Detection Order
- Reduce Edge Points
- Modification on Hough Transform
- Hypothesize and Verification

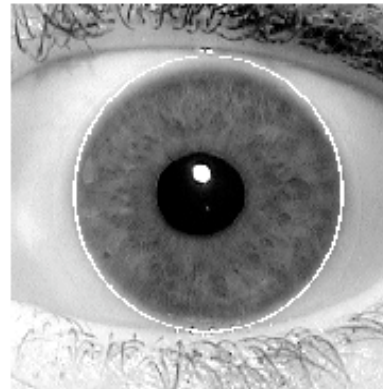
Reverse Detection Order



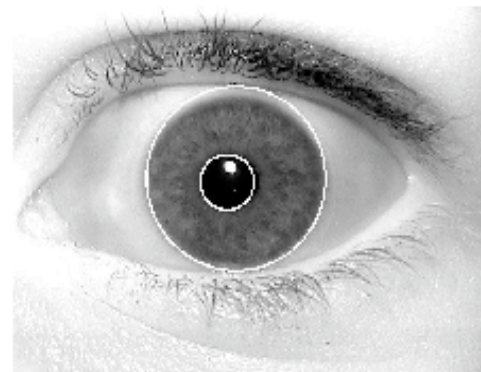
(a) Original iris image.



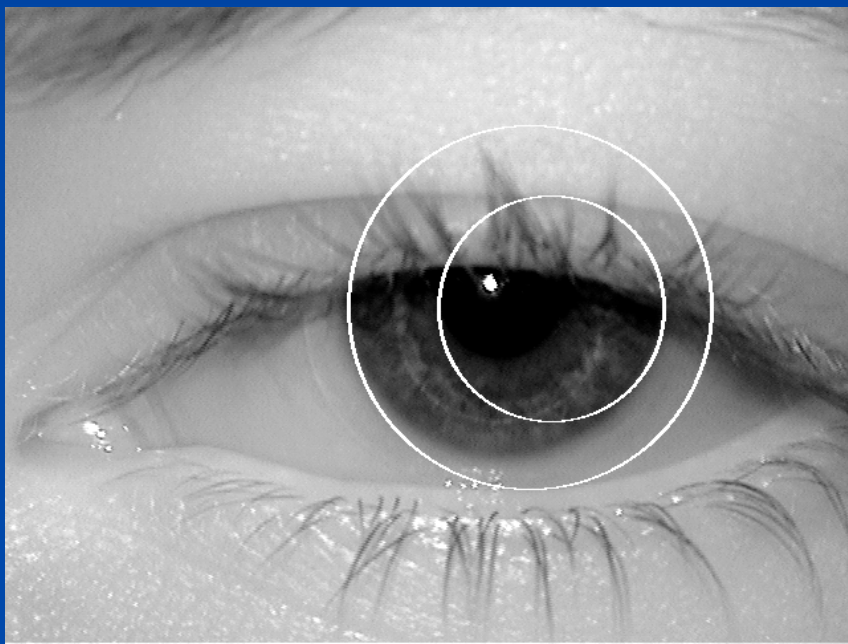
(b) Step 1: detect the inner boundary as the pupil.



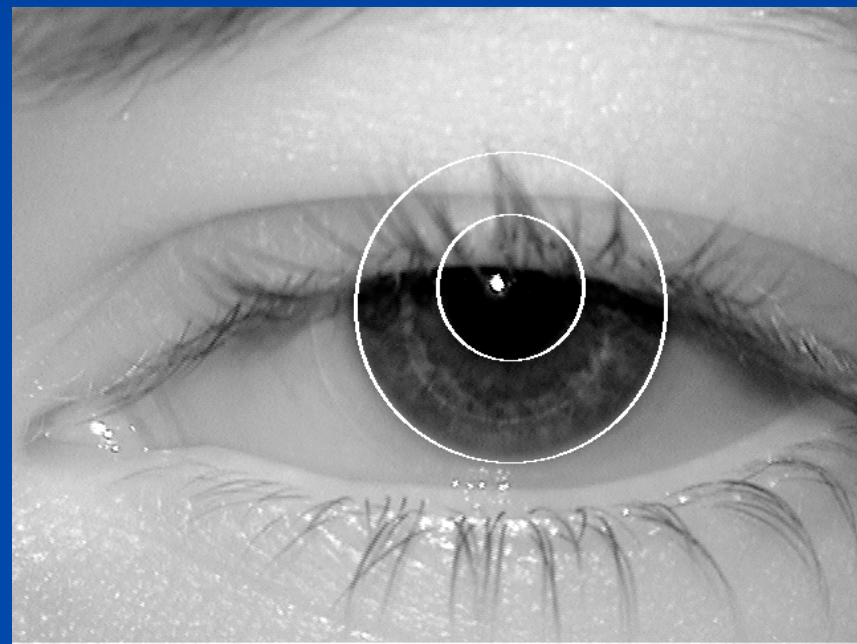
(c) Step 2: detect the outer boundary as the iris.



(d) Final result.

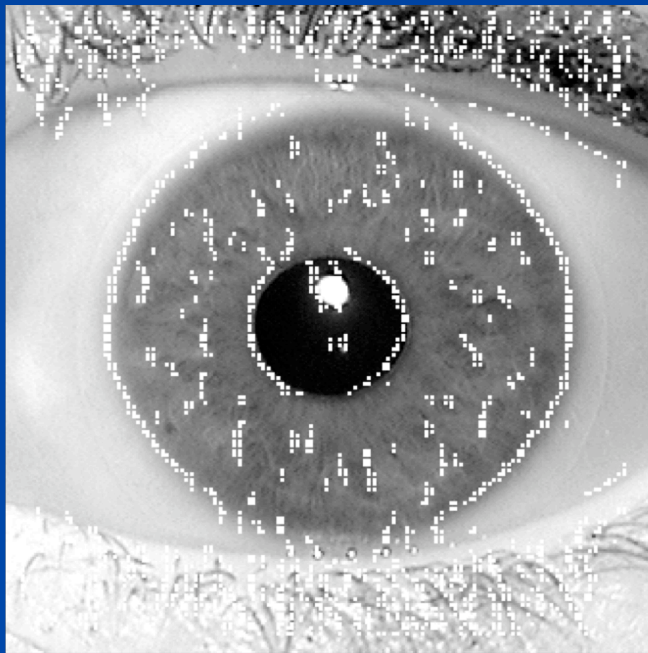


(a) Masek

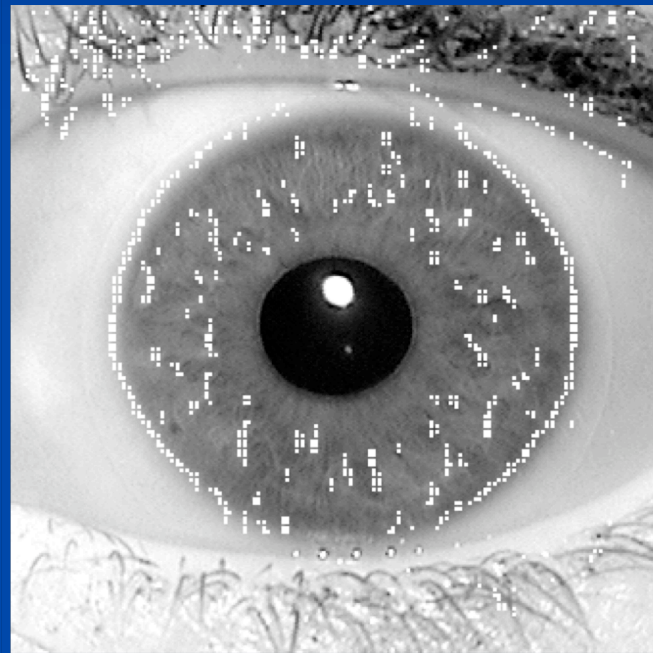


(b) ND_IRIS

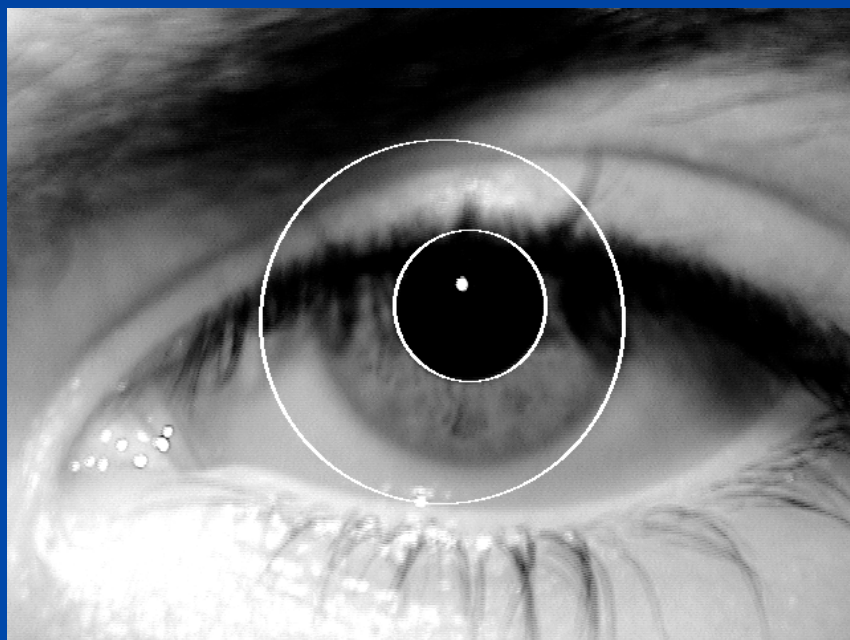
Reduce Edge Points



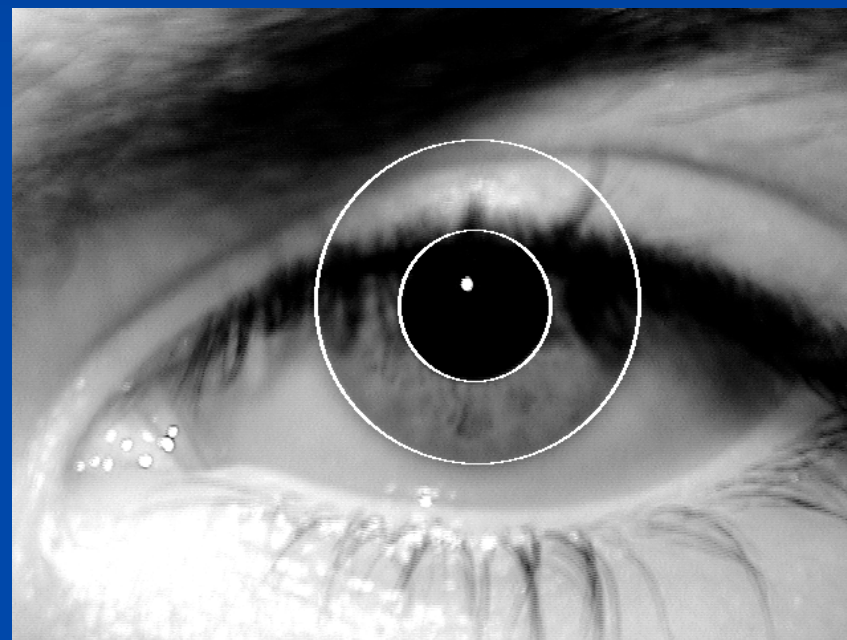
(a) Before reducing



(b) After reducing edge points

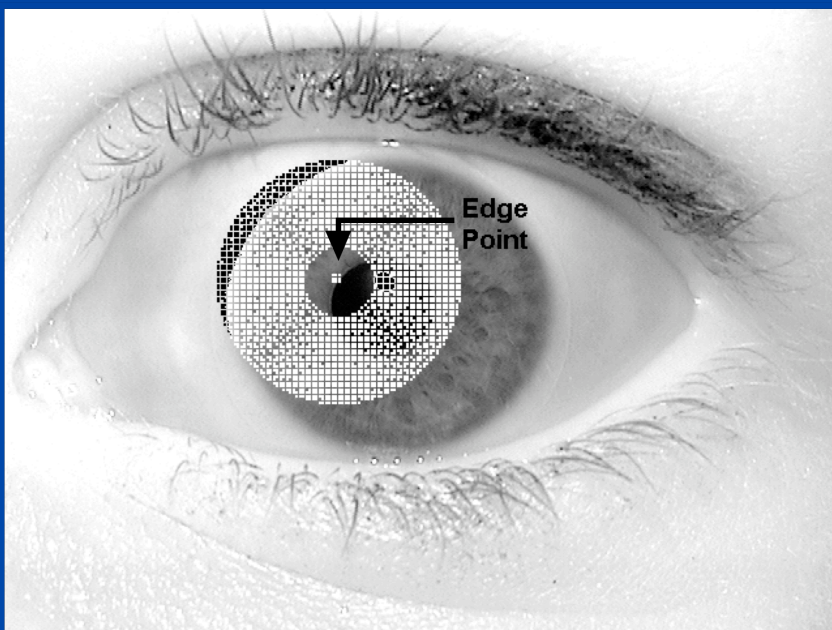


(a) Masek

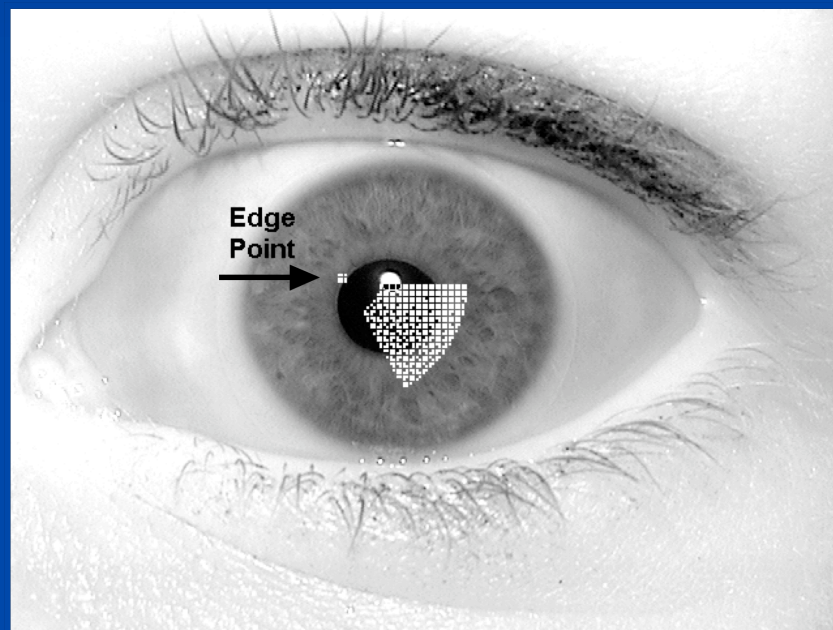


(b) ND_IRIS

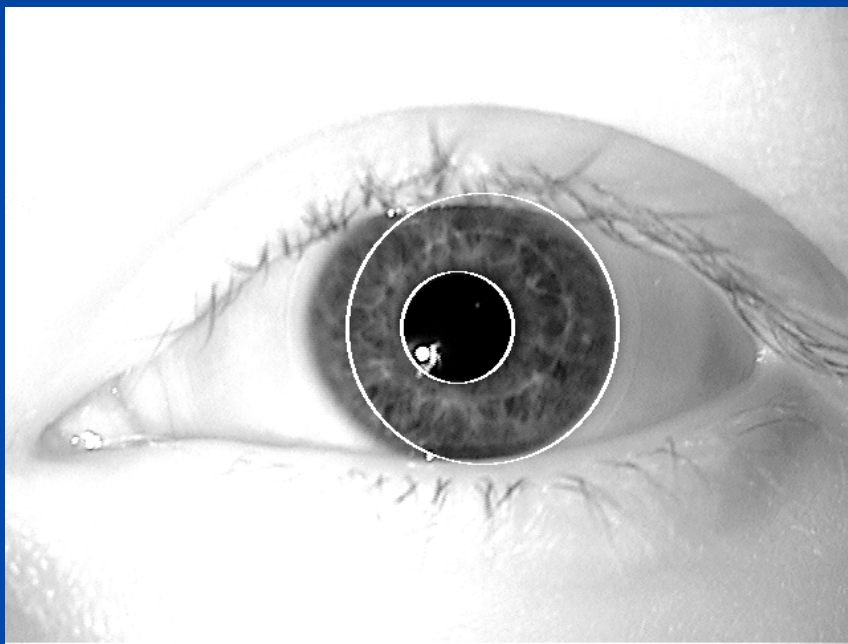
Modification to Hough Transform



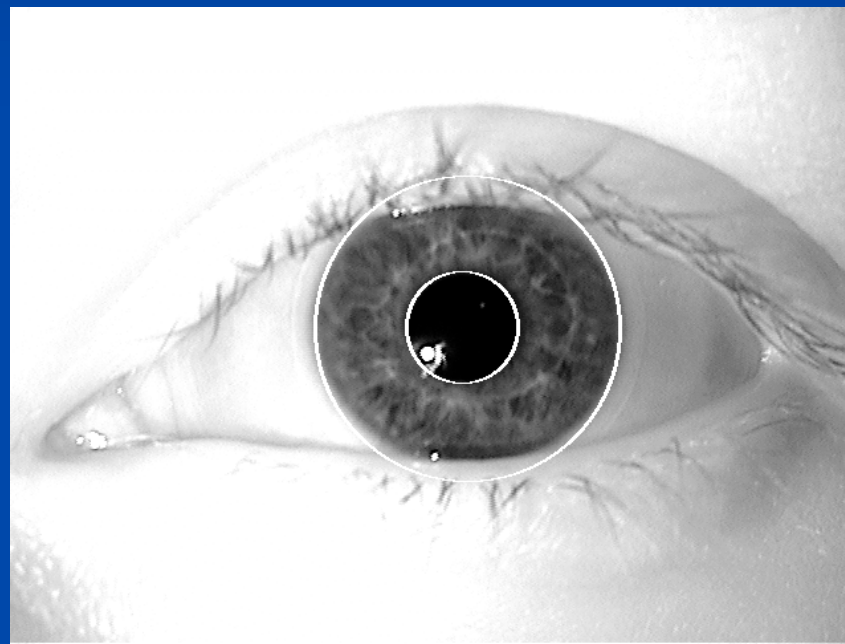
(a) Masek's Algorithm



(b) ND_IRIS

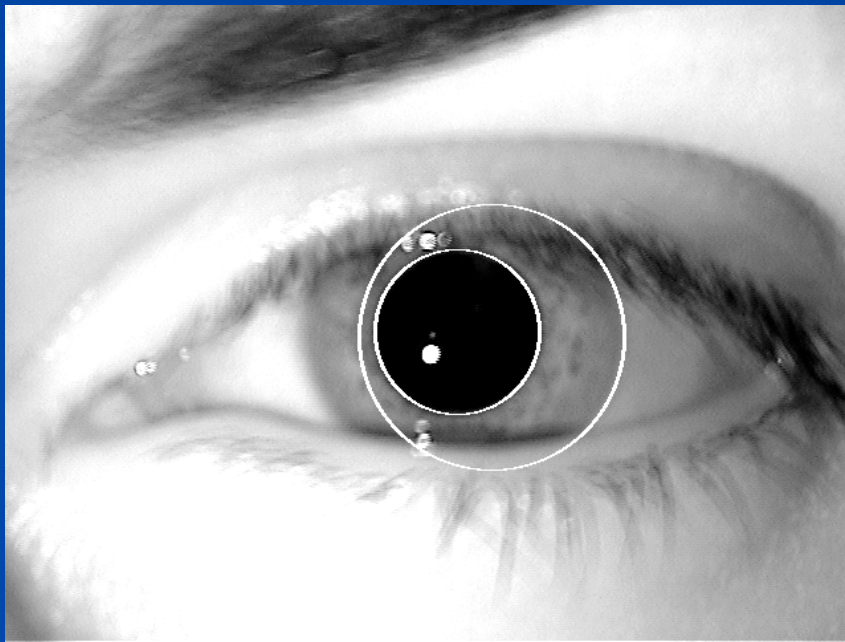


(a) Masek

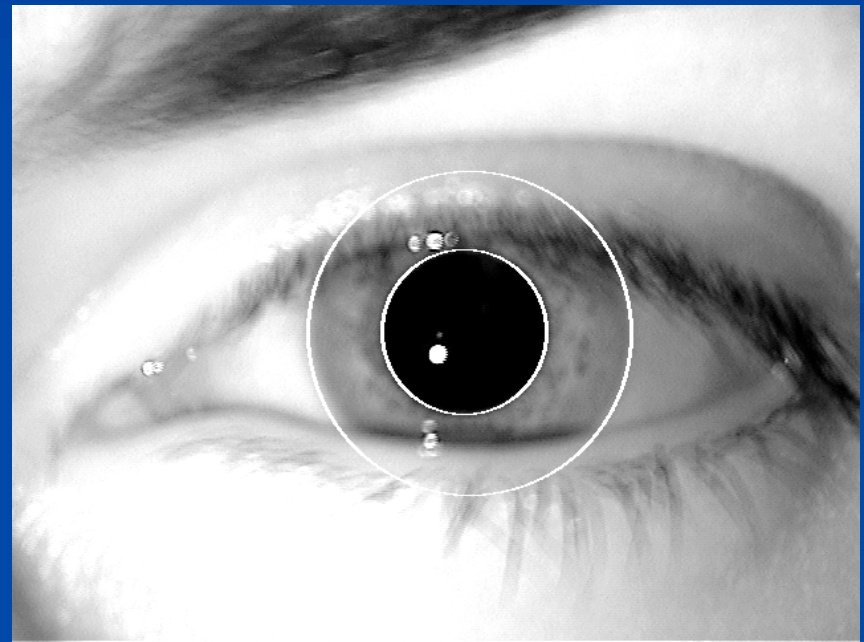


(b) ND_IRIS

Hypothesize and Verify

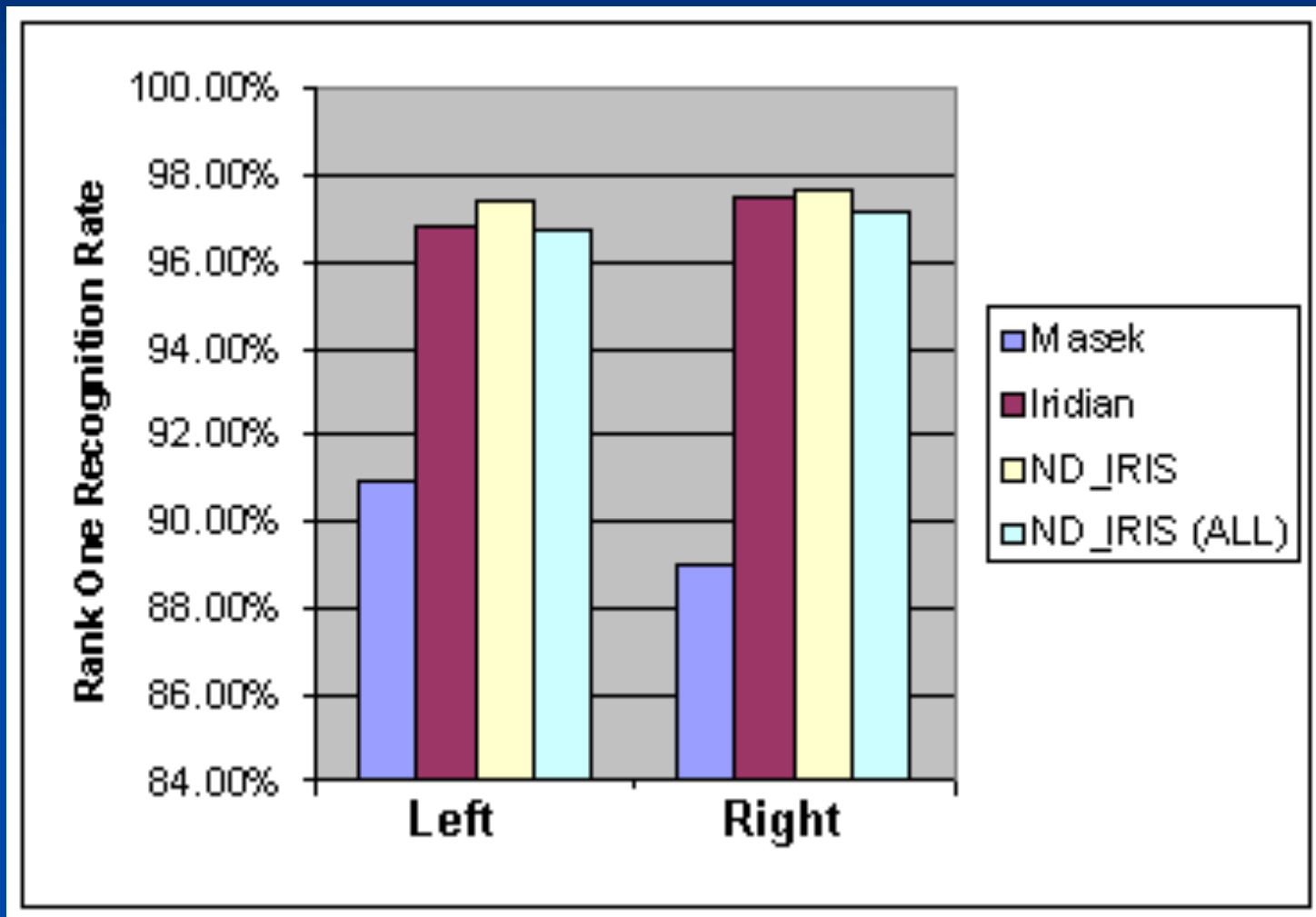


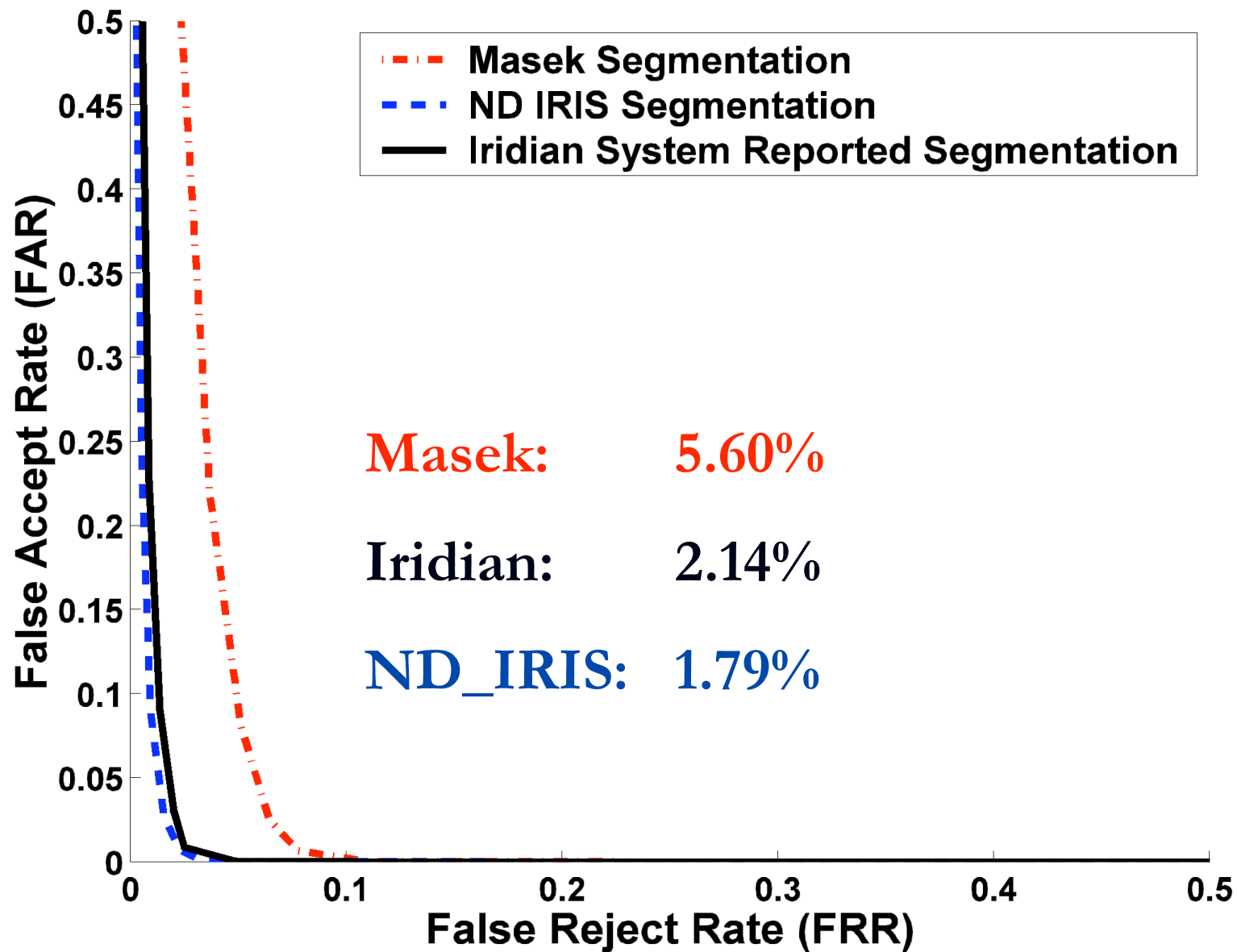
(a) Masek



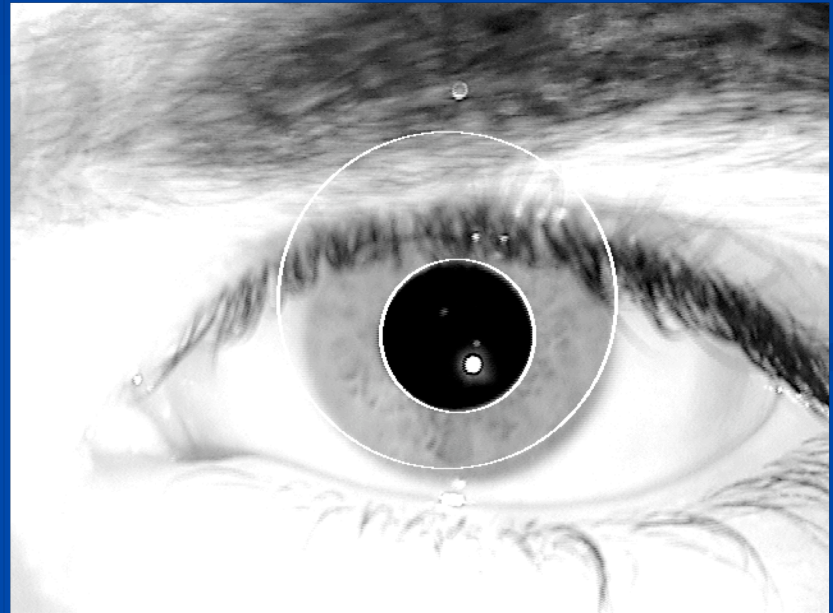
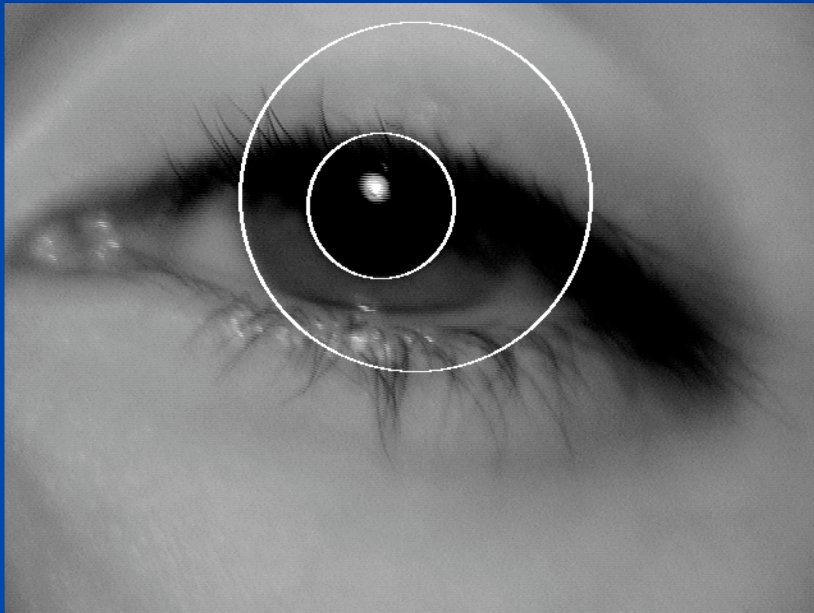
(b) ND_IRIS

Experimental Results





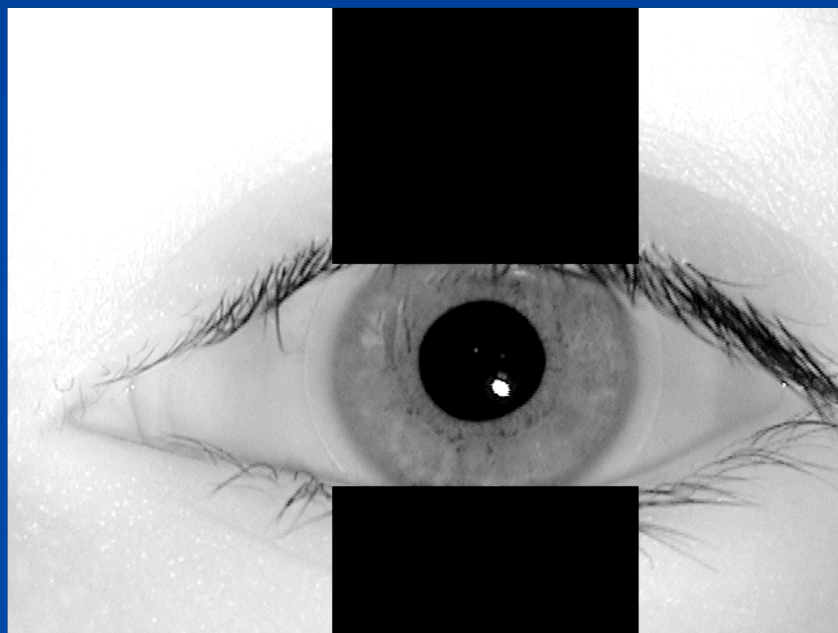
Incorrect Segmentations



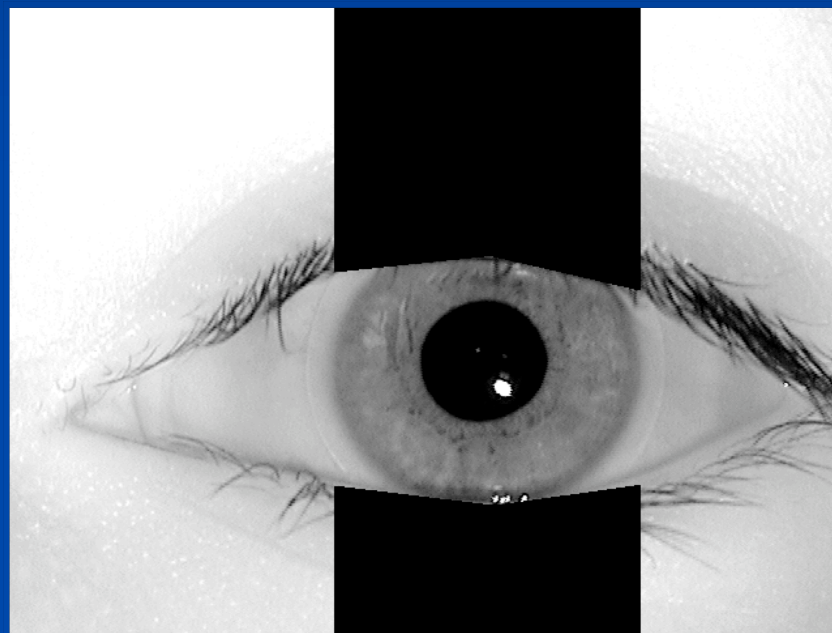
Observation

- Eyelids and eyelashes (chiefly the upper lid for our data) appear to be the big remaining complications.
- Is a more sophisticated segmentation technique worth more than more sophisticated texture metric?

Optimizations in Eyelid Detection



(a) Masek

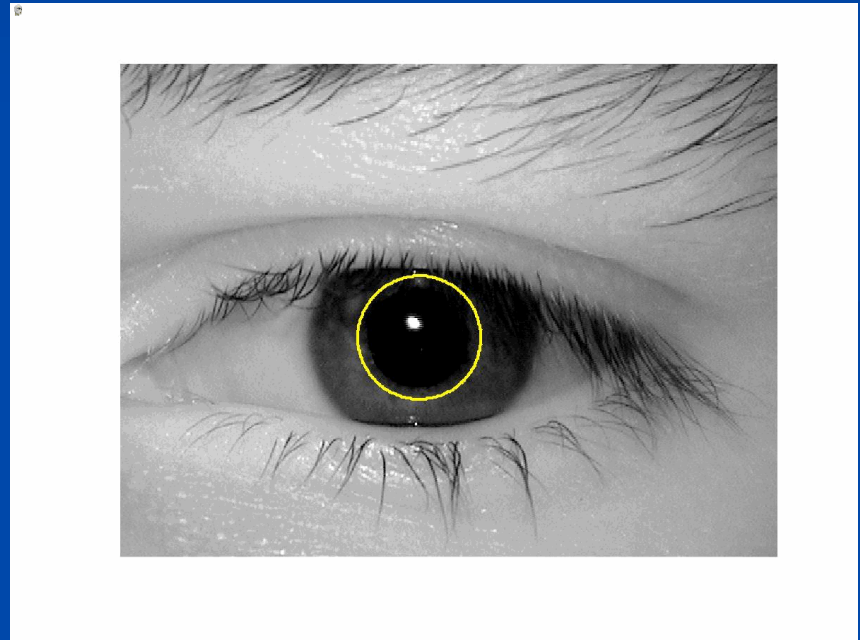


(b) ND_IRIS

Snake Model

■ Snakes:

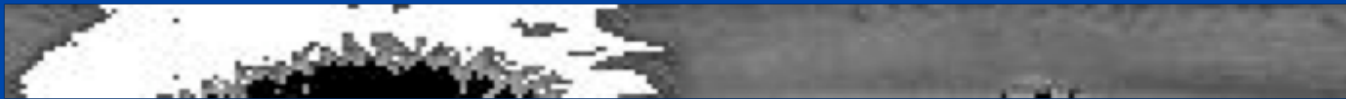
- Active contour model
- An energy minimizing spline pulled toward edges
- Demo
- Designed to deal primarily with occlusions, not with acircularity of the pupillary and limbic boundaries



Unwrapped Iris Images



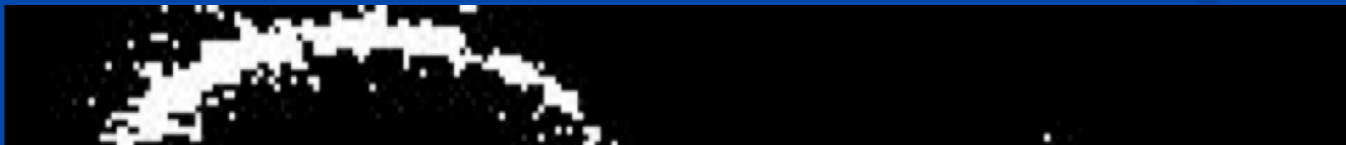
Initially Marked Noise Areas



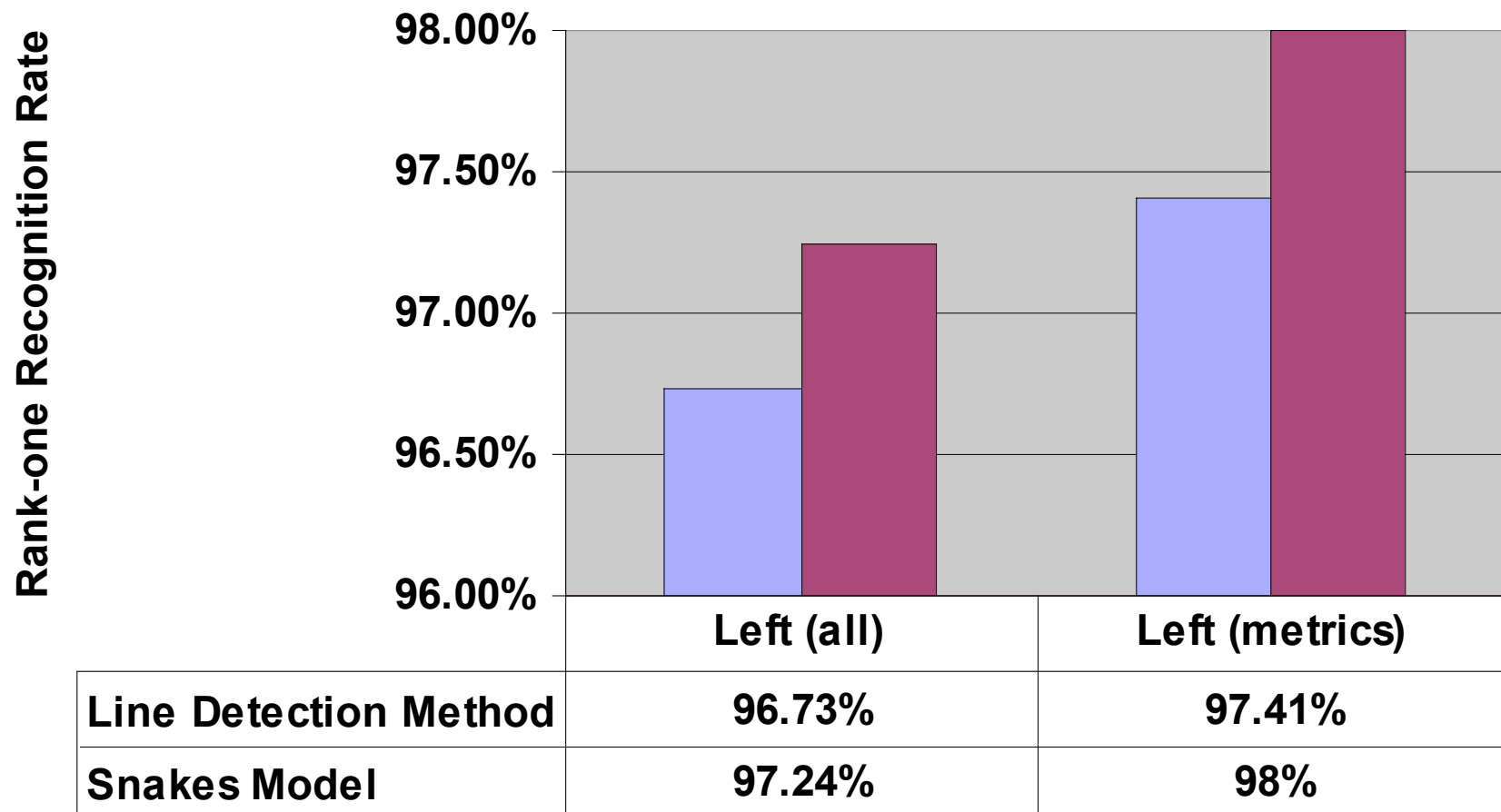
Results from the Snakes Model

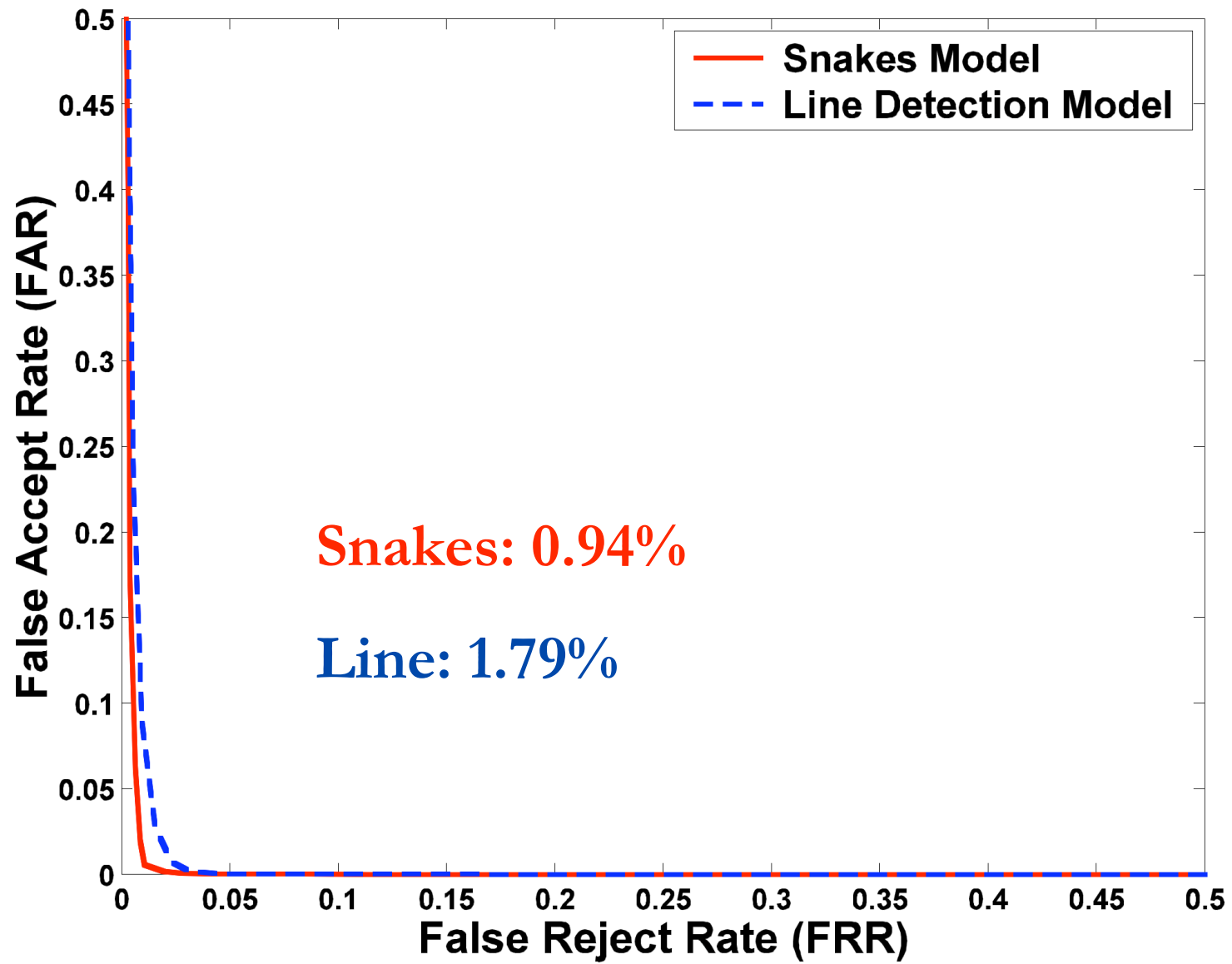


Results from Line Detection Model

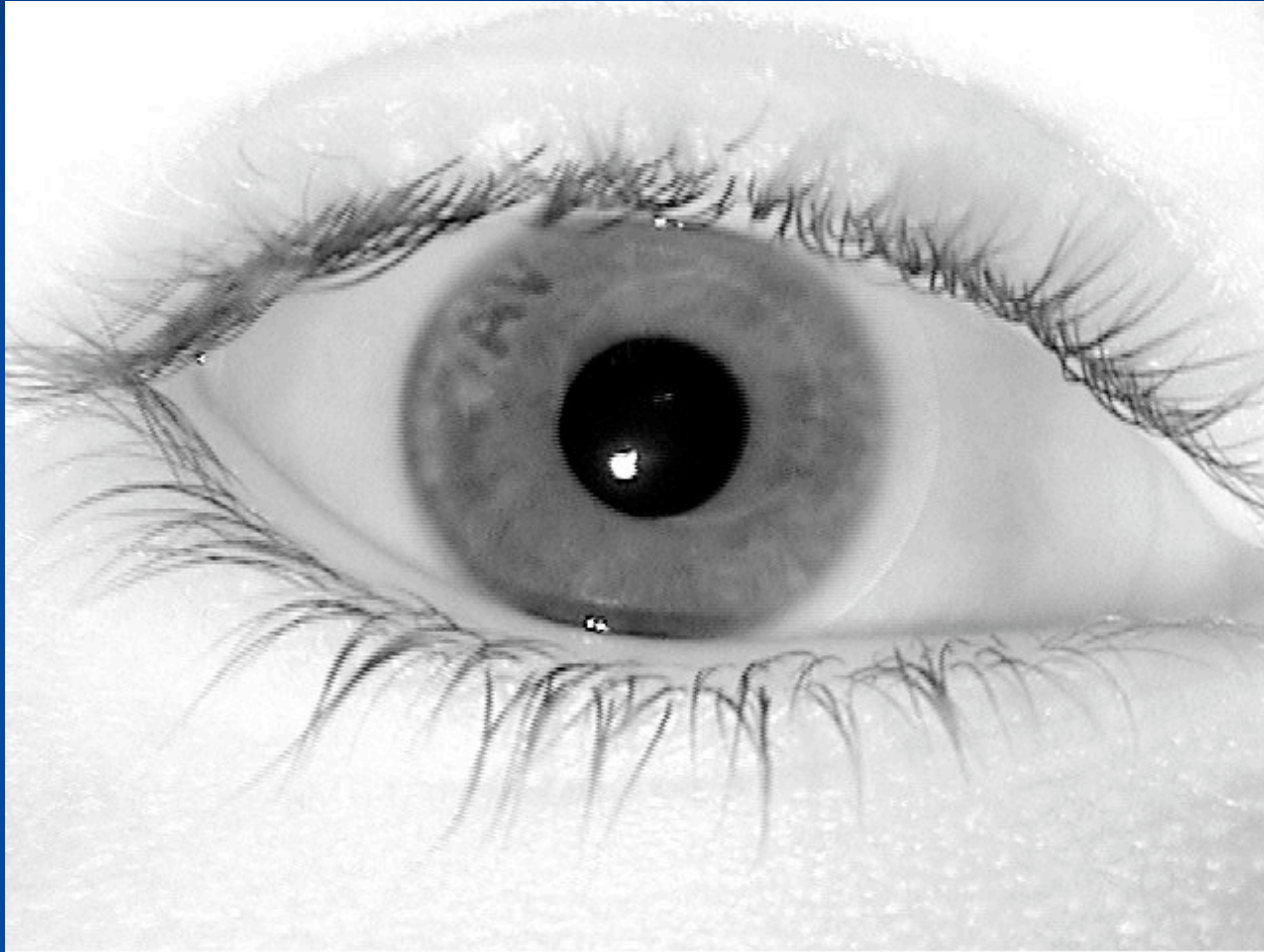


Noise Detection Methods Compared





Lens markings



Citation

X. Liu, K.W. Bowyer, P.J. Flynn, Iris Recognition and Verification Experiments with Improved Segmentation Method, *Proc. Fourth IEEE Workshop on Automatic Identification Advanced Techniques (AutoID 2005)*, October 2005, Buffalo NY, pp. 118-123.

Conclusion

- Re-implemented Masek's Iris Recognition System
- Optimized Iris Segmentation Stage
 - 6% higher rank one recognition rate than the Masek segmentation
 - A little bit higher than using the Iridian reported segmentation
- Optimized Noise Detection Stage
- Optimized Matching Stage
- Combined the Optimizations Together